

U.S. Patent Application Serial No. 09/670,399
Response filed August 19, 2004
Reply to OA dated March 26, 2004

REMARKS

Claims 1-25 are pending in this application, with claims 11-13 withdrawn from consideration. Claims 1, 2, 4-7 and 13-17 have been amended herein.

The amendments of substance to claims 1, 2, 4-7 and 14-17 are discussed below. Amendments are also made to claims 5, 6, and 16 correct minor typographical errors in the claims. The amendment to withdrawn claim 13 corrects an improper multiple dependency.

Regarding "Claims Analysis"

In this section of the Office action, the Examiner has indicated how he interprets the scope of several terms. Applicant has the following comments regarding the Examiner's definitions.

The Examiner defines the term "ligand" as anything that binds to the particle either temporarily or permanently. Applicant notes that the term "ligand" does not appear in the present claims.

The Examiner also defines the word "label" as "Anything which causes the particle or the ligand ... to produce a detectible signal ..." With regard to this statement, Applicants notes the word "label" is used as a verb in the claims and in the gerund form "labeling," but is not used as a noun in the claims.

The Examiner further states that "Anything that detects the label [is] a 'detection method.'" The term "detection method" does not appear in the present claims. Applicant assumes that this statement is directed to the preamble, "A method for detecting," in claims 5 and 15. Here, Applicant assumes that by "anything," the Examiner means "any series of steps."

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Claims 1-10, 15-17 and 24-25 are rejected under 35 U.S.C. §102(e) as being anticipated by Parton et al. (U.S. Patent 5,993,631).

The rejection of claims 1-10 and 24-25 is overcome by the amendments to claim 1, 2 and 4-7. The rejection of claims 15-17 is respectfully traversed.

Claims 1, 2 and 4-7 have been amended to recite that the nonuniform electric field has “an electric field strength of 500 kV/m or higher....” Claims 15-17 already have this limitation. Support for the amendment may be found in claims 15-17 and throughout the specification, for example, on page 7, second full paragraph.

The electric field strength parameter is not discussed explicitly in Parton et al., and no value for this parameter is given in the reference. Based on the disclosure in the reference, some inference can be made as to the electric field strength inherent in the teachings of the reference. The gap between adjacent electrodes is about 6 microns, and the distance between opposing electrode tips is 30 microns (column 12, lines 25-26). The peak-to-peak voltage amplitude is 5 V. Based on Fig. 1 of the reference, Applicant concludes that horizontally, the 5V was applied across 30 microns, for 130 kV/m. Vertically, the electric field would appear to be smaller, since the wavelength of the travelling field is 80 microns. Parton et al. therefore does not disclose or suggest the claimed limitation of 500 kV/m or higher.

In prior art, dielectrophoresis has been used (a) for separation of cells or latex particles (which are molecules lower in solubility into solution (or large molecules) than DNA or protein), and (b) mere collection of single DNA or protein, but dielectrophoresis has not been used for separation of small particles such as DNA or protein. The reason is that since the dielectrophoresis

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force depends on the size of particles, it has been considered that it is difficult to separate small particles such as DNA or protein; and in prior art, since separation has been carried out with electric field strength weaker than that of 500 kV/m, separation could not be made actually. The present invention has first succeeded to achieve separation of small particles such as DNA or protein by carrying out with electric field of 500 kV/m or more not taught by any of the cited references, without using.

Applicants therefore submit that Claims 1-10, 15-17 and 24-25 are not anticipated by, and are non-obvious over, Parton et al. (U.S. Patent 5,993,631).

Claims 1-10 and 14-25 are rejected under 35 U.S.C. §102(e) as being anticipated by Seul et al. (U.S. Patent 6,387,707 B1).

The rejection is overcome by the amendments to the claims. Claims 1, 2, 4-7, and 14-17 have been amended to recite that the nonuniform electric field is formed by “electrodes which are not light-sensitive.”

Although it is not explicitly stated in the specification of the present application that the electrodes “are not light-sensitive,” this negative limitation is inherent in the description of the electrodes. All of the electrodes of the present invention are electrodes formed of conductive material (metal), and are not light-sensitive (i.e., semiconductor). The electrodes of the present invention are formed of “conductive materials such as, for example, such as aluminum, gold and the like,” as may be seen from description of the specification of the present application, p.41, lines 15-17.

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The electrode in the present invention may be contrasted with the light-sensitive electrode of Seul, which is a Si/SiOx electrode, that is, a semiconductor electrode, which is an electrode formed of a semi-conductive material (semiconductor), not a conductive material. It is clear from descriptions of Seul, col. 2, lines 6-9, col. 9, lines 20-22, and col. 15, lines 43-45, that this light sensitive electrode is a Si/SiOx electrode consisting a silicon (Si) wafer and a silicon oxide (SiOx) film formed thereon (see Seul, col. 2, lines 9-12). In Seul, the silicon electrode is prepared by forming an oxide layer [silicon oxide (SiOx)] on the silicon (Si) wafer by means of UV-intervention oxide re-growth or UV-intervention photochemical oxide (see col. 3, lines 12-28; col. 9, lines 36-46; col. 13, lines 26-32).

Seul et al. is directed to light-controlled electrokinetic assembly of particles (abstract), and the light-sensitive, semiconductor electrode in Seul et al. is clearly required in the reference. Therefore, there is no suggestion in Seul et al. for forming the electric field with electrodes which are not light-sensitive. It is clear that the methods used by Seul differ from those of the present invention.

Applicants therefore submit that claims 1-10 and 14-25, as amended, are not anticipated by, and are non-obvious over, Seul et al.

Claims 1-10 are rejected under 35 U.S.C. §102(e) as being anticipated by Becker et al. (U.S. Patent 6,294,063).

The rejection of claims 1-10 over Becker et al. is respectfully traversed.

The Examiner cites Becker et al. for disclosing use of dielectrophoresis to manipulate

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“packets”. Becker et al. defines “packet” in column 2, line 53, to column 3, line 15. Becker et al. indicates that packets have a diameter between 100 nm and 1 cm.

The Examiner states that the reference teaches a method of forming a complex substance to separate out a specific molecule. However, the Examiner is not specific as to where this is taught and Applicant cannot find this teaching in the reference.

The Examiner does not address the issue of the nonuniform electric field. The reference does refer to “a field of non-uniform strength” in column 8, line 43, and following portions, and discusses a mathematical factor for “non-uniformities in the field magnitude (ΔE_{rms}^2)” (column 9, line 15, etc.), but it is not clear that this is a disclosure of applying a nonuniform electric field as in the present claims.

Applicant submits that Becker et al. does not appear to generally disclose the method recited in claims 1-10. Moreover, Becker et al. does not appear to disclose the limitation that nonuniform electric field has “an electric field strength of 500 kV/m or higher,” which has been added to claims 1-10.

Claims 1-25 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 15-21 and 27-28 of copending Patent Application Publication US 2001/0047941 A1.

The obviousness-type double patenting rejection is respectfully traversed.

U.S. Patent Application Publication US 2001/0047941 A1 is the publication of USSN 09/833,566. An amendment to the claims was filed in that application on February 25, 2004,

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canceling claims 1-14 and 27-28, and amending claims 15-21. Therefore, cited claims 15-21 are still pending (in amended form) in 09/833,566, but claims 27-28 are no longer pending. Applicant notes that the published claims of US 2001/0047941 A1 are not at issue in the rejection.

Claims 15 of USSN 09/833,566, in its present form, recites "A method of collecting substances" and recites steps including "subjecting said liquid containing substances to influence by a negative dielectrophoretic force" Claim 17 introduces "a substance binding to a substance to be measured".

In traversing the rejection, Applicant submits that the claims of USSN 09/833,566 do not suggest the "nonuniform electric field" limitation of the present claims.

Moreover, with regard to present claims 4-7, there appears to be no suggestion in claims 15-21 of USSN 09/833,566 for the additional "substance binding to the specific molecule" recited in claims 4-7.

In addition, Applicant submits that there is no suggestion in the claims of USSN 09/833,566 for the limitation of "an electric field strength of 500 kV/m or higher," which has been added to the present claims.

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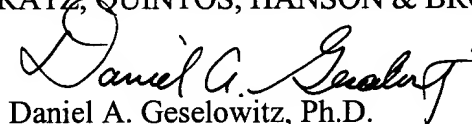
Reconsideration of the rejections is therefore respectfully requested.

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact Applicant's undersigned agent at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

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